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U. S. DEPARTMENT OF
AGRICULTURE

FARMERS' BULLETIN No. 1467

COMMERCIAL
VARIETIES
of
ALFALFA



THE ALFALFAS of this country may be divided into five somewhat distinct groups: Common, Turkestan, variegated, nonhardy, and yellow flowered. These vary in their adaptation to climatic conditions and length of day, some giving the best results in the North and Northwest, whereas others succeed only in the South and Southwest.

Common alfalfa is a term that is used to include all of the alfalfas that are not clearly of hybrid origin or that do not have distinct and uniform varietal characteristics, such as the Peruvian and Arabian varieties. Numerous strains are recognized in the group, such as Kansas common, Dakota common, dry-land alfalfa, and irrigated alfalfa.

Indications are that Argentine and South African alfalfas are at least no hardier than Kansas common and therefore are not suitable for growing in our Northern States.

The commercial Turkestan alfalfa has been tested quite thoroughly in all parts of this country and in most cases has proved inferior to American-grown strains.

The Grimm variety is the most important of the variegated alfalfas. Other alfalfas in this group are Baltic, Cossack, and Canadian variegated. They have been found more resistant to cold than other commercial varieties or strains and are therefore recommended for sections where winterkilling occurs frequently.

In the nonhardy group, Peruvian alfalfa is the only variety that is commercially important in the United States. This variety comprises two distinct strains, the smooth Peruvian and the hairy Peruvian. These alfalfas are not resistant to cold and can be grown successfully only where the winter temperature is comparatively mild, as in the Southern and Southwestern States.

The alfalfas of the yellow-flowered group, sometimes referred to as Siberian alfalfa, rarely give more than one cutting of hay and produce seed very scantily. They are of comparatively little agronomic importance.

This bulletin is a revision of Farmers' Bulletin No. 757, which it supersedes.

COMMERCIAL VARIETIES OF ALFALFA

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CONTENTS

	Page		Page
Varieties and strains of alfalfa-----	1	Variegated group—Continued.	
The common alfalfa group-----	2	Sand lucern-----	11
Domestic strains-----	3	Nonhardy group-----	12
Provence strain-----	5	Peruvian-----	12
Argentine alfalfa-----	5	Arabian-----	14
South African alfalfa-----	6	Yellow-flowered group-----	15
Turkestan group-----	6	Varieties for various sections-----	17
Variegated group-----	7	Purchasing seed-----	19
Grimm-----	8	Seed production-----	20
Baltic-----	9	Possibilities in breeding-----	21
Cossack-----	10	Publications relating to alfalfa-----	21
Canadian variegated-----	10		

VARIETIES AND STRAINS OF ALFALFA

IT IS ONLY within the last 25 years that varieties of alfalfa have been recognized commercially in the United States, and only within the last 15 years have they been given really serious attention. Prior to 1898 no commercial distinction was made between the various lots of alfalfa seed sown in this country, whether they were of foreign or domestic origin. Coincident with the introduction of alfalfa into the various sections of the United States there developed an interest in varieties or strains for special conditions. This interest has resulted in the recognition and adoption of several fairly distinct commercial varieties and strains that show great diversity in their climatic and latitude relations. Some give the best results in the North and Northwest, where the winters are cold and the days are longer during the growing season than they are farther south; others do better in the extreme South and Southwest, where the winters are mild and the days during the growing season are relatively short.

These alfalfas have been produced mostly in nature, with almost no intentional effort on the part of man. The hybrid varieties are natural crosses, and the distinct types of pure origin are the products of natural selection. However, it is hoped that the results of the systematic plant breeding that has been conducted by the Department of Agriculture and the State agricultural experiment stations during the past decade will soon be available to the general public and that these efforts will produce strains or varieties of alfalfa that will be superior even to the best commercial ones that are now available. The present need is perhaps the greatest for alfalfas that will give profitable yields under the extreme conditions of moisture that exist, broadly speaking, in the West and in the East; that is, for the humid sections and for the semiarid sections, since in these sections the effort to extend the culture of alfalfa is the most active. Just what may develop in these regions from improved methods of cultivation and better adapted varieties can not be foretold.

The commercial alfalfas of this country may be divided into five somewhat distinct groups, each containing strains or varieties that vary considerably within themselves. These groups may be described briefly as follows:

The common group includes the ordinary purple-flowered smooth alfalfa, of which there are numerous regional strains generally grown throughout the western part of the United States and in foreign countries.

The Turkestan group includes alfalfas that have been developed in Turkestan. They differ from the common alfalfas of this country in that they are somewhat shorter and more spreading in habit of growth and are slightly more hairy. No commercial distinction is made between the various strains from Turkestan, all of them being sold under the name "Turkestan."

The variegated group includes the alfalfas that have originated from crosses between common alfalfa¹ and the yellow-flowered species.² The Grimm, Baltic, Cossack, Canadian variegated, and sand lucern are the best-known examples of this group.

The nonhardy group includes rather distinct varieties that are very susceptible to low temperatures. They are, in general, very erect in habit of growth, recover quickly after cutting, and have a long growing period. The Peruvian and Arabian varieties are members of this group.

The yellow-flowered group includes the various forms of the yellow-flowered species. They are easily distinguished from members of the other groups by their yellow flowers and crescent or sickle shaped pods.

In this bulletin the word "strain" is applied to alfalfas that are only slightly different from those that are typical of the ordinary purple-flowered alfalfa and also occasionally to alfalfas that belong to other groups, where they are considered with reference to these groups. The alfalfas of the common group that have developed in various regions are called "regional strains" and not "varieties," since they do not possess sufficiently distinct characters to be considered as varieties; on the other hand, the Grimm alfalfa, for example, which is referred to as a "variety" when considered in connection with the common alfalfas, may be spoken of properly as a "strain" of variegated alfalfa.

Lack of distinct differences in the seeds of the several varieties and strains, and also in many cases in the appearance of their vegetative growth, has made it difficult for farmers to recognize them readily and has resulted in much careless and unscrupulous dealing on the part of seed producers and seedsmen. There seems to be such a general lack of knowledge with regard to the characteristics of our commercial alfalfas and so much misinformation has been circulated, which has resulted in many cases in disappointment and financial loss, that it is believed an agronomic treatise on the varieties that have been generally advertised and more or less discussed in agricultural literature will be helpful at this time.

THE COMMON ALFALFA GROUP

Comparatively little is known with regard to the origin of common cultivated alfalfa, although there is good reason to believe that it developed in western Asia and was one of the first plants to be cultivated solely for forage. Since alfalfa naturally is an open-fertilized plant, it is difficult to determine just how many strains are included in what we now call "the common variety."

The alfalfa seed that was first sown in this country was introduced from various parts of Europe, but the stock from which most of the

¹ *Medicago sativa*.

² *Medicago falcata*.

common alfalfa of our Western States has been produced was brought to Chile from Spain and after having been grown there for many years was introduced into California about 1850. In the Southwest this alfalfa is very generally known as Chilean alfalfa, but for lack of a better term in most other parts of the United States it has been designated as "common alfalfa." To be more specific, the term "common alfalfa" has been used to include all of the alfalfas that are not clearly of hybrid origin or that do not have fairly distinct and uniform varietal characteristics, even though within this group what are known as regional strains are coming to be recognized.

In most lots of common alfalfa there occur some plants that grow more quickly than others after being cut. These plants also have a tendency to produce somewhat heavier yields and differ from the others in general habit of growth. They are more erect and have comparatively small crowns, which are produced well above the surface of the ground. In contrast to these there are plants that are slightly procumbent in habit of growth and have comparatively broad crowns, which are produced somewhat below the surface of the ground. The plants of the first type are favored by mild climatic conditions, but succumb readily to severe winters. This type of plant is sometimes referred to for convenience as the "southern or nonhardy type." Plants of the second type are hardy and predominate as a result of the elimination of the more tender individuals in strains that have been developed in cold climates. This particular type is often referred to as the "northern or hardy type." These two types of plants furnish a basis for the development of regional strains, which, as they are at present defined, are produced when common alfalfa is grown for several seed generations in definite localities where eliminating conditions of one kind or another normally prevail.

To illustrate what is meant by "seed generation," the seed produced from the original sowing may be said to be the first seed generation. If this be sown and seed produced from it, such seed would represent the second seed generation, and if this practice is continued for a considerable number of generations under eliminating conditions it will have a tendency to produce a fairly distinct strain of alfalfa. A difference is now being recognized between lots of alfalfa that have been grown for several seed generations in the various States. To such lots names of the States or terms descriptive of the conditions under which they were produced are sometimes applied, as, for example, Kansas-grown alfalfa, Montana-grown alfalfa, irrigated alfalfa, dry-land alfalfa, and many others. Certain regional strains produced in foreign countries are also recognized.

DOMESTIC STRAINS

The names "Kansas-grown" and "Montana-grown," as used in the general seed trade, are not necessarily distinctive. The mere fact that a certain lot of alfalfa seed was grown in Kansas or Montana is of no importance unless such lots of seed were produced as a result of several seed generations grown in those States. The same is true of seed called in the trade "dry-land," "irrigated," and "nonirrigated" alfalfa, and it is safe to say that much undue dis-

crimination has developed in connection with its sale. Just how many seed generations are required before a variety growing in one locality assumes rather definite characteristics doubtless varies with the nature of the eliminating climatic conditions and can not be estimated accurately. Fortunately, much of the seed which is grown in each section that produces seed with a fair degree of consistency has come from stock that has been grown in that section for several seed generations. However, it is always well for a prospective purchaser to investigate this point if possible. The history of seed advertised as "dry-land" or "nonirrigated" should be investigated very carefully before purchasing if a price materially above the prevailing price for ordinary seed is asked, inasmuch as the history of such seed is often very uncertain.

The so-called regional strains produced in Kansas, Oklahoma, and other States having similar conditions have a tendency to recover more quickly after cutting and to give better yields than strains pro-

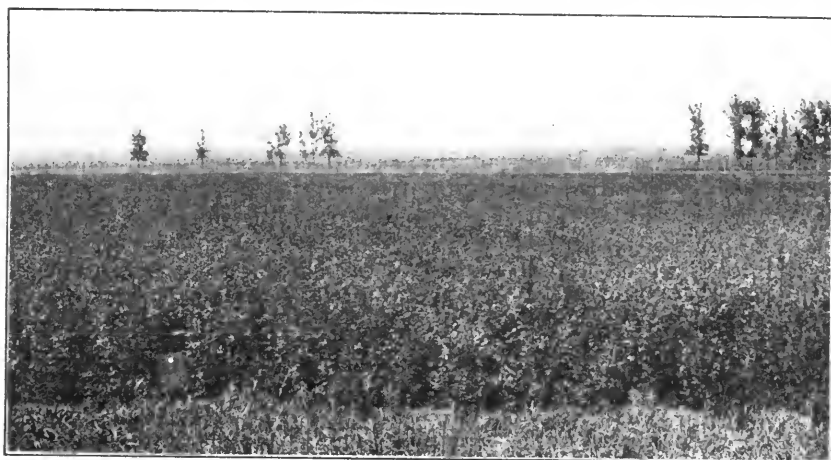


FIG. 1.—A field of common alfalfa from Kansas-grown seed

duced farther north. This characteristic has apparently been the result of latitude and climatic conditions favoring the perpetuation of the more rapid-growing and high-yielding individuals, until a strain is produced that has these characteristics to a rather definite degree. The regional strains from the above sources, therefore, are recommended in sections having a similar latitude where the winterkilling of alfalfa normally is not a serious factor. (Fig. 1.)

The common alfalfa grown west of the Rocky Mountains is very similar in its characteristics to that grown in Kansas, Oklahoma, and Texas, and careful tests show that it gives approximately the same results in sections having comparatively mild winters. In general, however, alfalfa seed from west of the Rocky Mountains has not proved quite so hardy as that grown in the same latitude on the Great Plains. Where winterkilling occurs with a considerable degree of frequency, the strains of alfalfa developed in the Northern States are preferable to those produced farther south. Regional strains from northern Nebraska, the Dakotas, and Montana are at least somewhat hardier than those developed in Kansas, Oklahoma,

and Texas, or the intermountain region, owing, presumably, to the fact that the severe winters of the North have effected the elimination of a great many of the tender individual plants. These northern strains of common alfalfa are seemingly less productive at lower latitudes than those from the South, but their tendency toward greater hardiness and their apparent ability to produce higher yields in the North make their use advisable for sowing there.

It is reasonable to assume that where alfalfa is grown under conditions of scant moisture there is some elimination of the less drought-resistant individuals and that if elimination continues throughout a large number of generations a strain superior in drought resistance must necessarily result, just as comparatively hardy strains have developed, for example, in the Dakotas and Montana. It must be admitted, however, that the tests conducted by the United States Department of Agriculture and the results of those published by State agricultural experiment stations have not revealed a materially superior drought resistance of dry-land-grown alfalfa over the common alfalfa grown either under irrigation or where rainfall is fairly abundant. The probable explanation is that the lots which were tested had not come from a sufficiently large number of seed generations grown under conditions of scant moisture. It is very doubtful whether much of the seed offered upon the market as "dry-land" or "nonirrigated" is in the least degree superior to that grown under irrigation or in the so-called rain belt.

PROVENCE STRAIN

Provence is the name that is applied to a strain of alfalfa grown in southwestern France. According to the definition formulated at the beginning of this bulletin, it is classed as a regional strain of common alfalfa and not as a distinct variety. It was doubtless introduced into this country at an early date, but there is no record of its introduction under the name of Provence until 1898, when the Department of Agriculture procured a small quantity of seed for testing. It was apparently shortly after this date that the name was used commercially and the seed received limited recognition by the seed trade.

The Provence strain differs so slightly in general appearance from the common regional strain from Kansas that one can scarcely be distinguished from the other. There are, however, a few differences of some importance. The Provence commences growth earlier in the spring and continues to grow later in the fall in the southern part of the United States than does the strain from Kansas. It also makes somewhat quicker growth after cutting. However, it is not quite so hardy and can not be recommended generally north of the central part of the United States.

Although the true Provence strain is an excellent one for sections in which severe winters do not occur, it is not commercially important in this country.

ARGENTINE ALFALFA

In recent years a large part of the alfalfa seed that has been received from foreign sources has come from Argentina. Practically all the alfalfa grown in that country belongs to the common group. Several more or less distinct strains have developed, as a result of

having been grown under widely varying conditions of climate and latitude. Most of the seed that reaches the United States is produced south of Buenos Aires, but the climatic conditions there are much less severe than for a similar latitude in this country and therefore not conducive to the development of a hardy strain. It should be remembered that the seasons for Argentina are the reverse of ours. Our climate becomes warmer southward; theirs becomes warmer northward. The tests that have thus far been conducted in the United States indicate that the hardiest strain of Argentine alfalfa is no hardier than our Kansas common alfalfa. For this reason the prospective grower should play safe and sow it no farther north than Kansas alfalfa is known to succeed. In the southwestern part of the United States some strains of Argentine alfalfa compare very favorably with the local-grown common.

SOUTH AFRICAN ALFALFA

During the past few years enough alfalfa seed from South Africa has reached the United States to stimulate a few inquiries regarding its suitability for this country. As the most southerly point of Africa is no farther south of the Equator than the southern line of Tennessee is north of the Equator, it is evident that the climatic conditions have not been conducive to the development of a hardy alfalfa. The preliminary tests conducted in the United States with alfalfa from South Africa show some variation, but the indications are that the commercial lots are of the common variety and can not be grown with safety quite so far north as our Kansas common alfalfa. Farther south South African alfalfa probably will compare favorably with local strains of common alfalfa.

TURKESTAN GROUP

Ever since 1898, when the Department of Agriculture introduced several lots of alfalfa seed from Turkestan, all of the commercial seed coming from that country has been classed under the name "Turkestan alfalfa," regardless of its characteristics or history. The strains introduced by the department were selected from regions having low rainfall and rather extreme temperatures, where they had been grown for many seed generations. These early importations gave such promising results in the cold, dry portions of this country that a demand at once was created for seed from Turkestan. This demand resulted in the importation of miscellaneous lots of seed from all parts of Turkestan where seed could be obtained profitably, much of which came from Russian Turkestan, where it was produced under irrigation. There is, nevertheless, considerable similarity among the various commercial lots of Turkestan alfalfa.

The alfalfas that have been received from Turkestan, as compared with the commercial strains of common alfalfa grown in this country, are usually characterized by a lower and somewhat more spreading growth, smaller and slightly more hairy leaves and finer stems. But it is almost impossible even for a trained botanist to distinguish between individual plants of Turkestan alfalfa and those of the common American-grown strains, so that confusion often occurs.

Generally speaking, commercial Turkestan alfalfa has proved to be inferior to the American-grown strains in nearly every case where

comparative tests have been conducted. In the eastern half of the United States, where alfalfa seed is not produced in commercial quantities, imported seed was used almost exclusively until within the past few years. This fact undoubtedly accounts for many of the failures that occurred with alfalfa in the Eastern States. In brief, the commercial Turkestan alfalfa yields less than the common American-grown strains, is shorter lived, and is less hardy than the Grimm, Cossack, and Canadian variegated. It is therefore not a desirable variety for farmers to purchase. Fortunately, commercial Turkestan alfalfa seed can be identified in most cases by the seed of Russian knapweed³ which it almost invariably contains. The seed of this weed is not found in commercial alfalfa seed from any other source. Being considerably larger than alfalfa seed, of an oblong shape, and of an ivory, whitish color, it can usually be distinguished with little difficulty. (Fig. 2.)

In recent years comparatively little Turkestan seed has reached the country, though there is no reason to believe that it may not again become a factor.

VARIEGATED GROUP

Wherever the ordinary purple-flowered alfalfa and the yellow-flowered species are grown side by side a natural hybridization takes place, which results in crosses that show to a greater or less extent the characteristics of both parents. These crosses subsequently intercross among themselves and with the original parent stock, particularly the common alfalfa, thus producing numerous forms which show considerable range in flower colors. The predominant color of the flowers is the same as of the ordinary alfalfa, but brown, green, greenish yellow, and smoky hues are not uncommon, and occasionally pure-yellow flowers occur. It is because of this range in flower color that the name "variegated" has been assigned to the group.

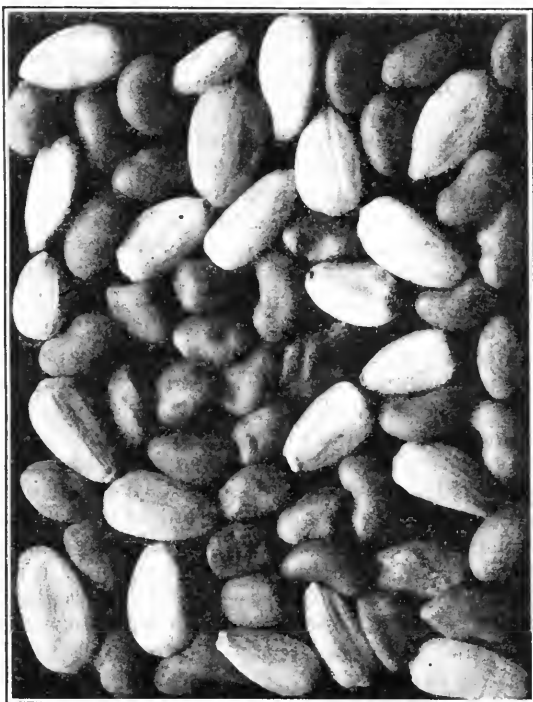


FIG. 2.—Seeds of Russian knapweed mixed with alfalfa seeds. (Magnified five diameters.) This sample shows a much larger proportion of the weed seeds (distinguished by their lighter color and their symmetrical form) than is ordinarily found in Turkestan alfalfa seed.

³ *Centaurea pteris*.

The various members of this group are so similar that it is seldom possible to distinguish between any two of them, but almost anyone can learn to distinguish a field of variegated alfalfa from one of common alfalfa with a considerable degree of certainty by observing the flower colors and the form of the seed pods. While the greater proportion of the flowers of the variegated alfalfas are the same as those of the common alfalfas, a close examination will reveal some plants having greenish or smoky flowers, and occasionally a pale or yellow one. Furthermore, the seed pods in a field of variegated alfalfa show considerable range in form. Some are circular, semicircular, or loosely coiled, but by far the greater portion of them resemble very closely the compactly coiled pods which alone occur in fields of common alfalfa. In the earlier stages of growth, however, there is no satisfactory way of distinguishing between the variegated and the common groups.

As a rule, the alfalfas that belong to the variegated group are more resistant to cold and drought than the other commonly grown varieties or strains, undoubtedly owing in a considerable degree to the presence in their ancestry of the yellow-flowered characters. This yellow-flowered species is characterized by its hardiness and drought resistance and occurs naturally over a large portion of Europe and Asia that is too cold and dry for the ordinary purple-flowered alfalfas. It is very probable that a great many lots of alfalfa that exhibit no marked tendency toward hardiness have some trace of the yellow-flowered alfalfa in their ancestry. Their lack of hardiness may be accounted for partly by the fact that the yellow-flowered species has exerted only a slight influence and partly by the fact that they were probably developed in mild climates. Variegation in the color of the flowers is not positive proof of a variety's hardiness, but it is at least a fair indication. Of the large number of strains of variegated alfalfa in question, the Grimm and Canadian variegated are the only ones that are commercially important. The Cossack has been advertised extensively and is receiving increasing attention. Baltic alfalfa and sand lucern were formerly of considerable prominence in the United States, but they are now grown to only a limited extent.

GRIMM

According to the account published by the Bureau of Plant Industry in Bulletin No. 209, Grimm alfalfa was introduced into Carver County, Minn., in 1857, by Wendelin Grimm, an immigrant from Baden, Germany. It is said that the original lot of seed, which did not exceed 15 or 20 pounds, was sown in the spring of 1858. Accounts differ as to its hardiness and the success at first attained with it. However, a sufficient number of plants survived the rather severe winters to enable Mr. Grimm to save small quantities of seed from time to time for future sowings. The first considerable quantity was apparently produced in 1867, when 480 pounds were threshed from 3 acres and sold in Minneapolis for 50 cents a pound. During subsequent years Grimm's neighbors attempted to grow alfalfa from seed produced in other parts of the United States, but in practically every case the sowings were entirely winterkilled, while at least some of the Grimm plants came through in good condition. The real value of the Grimm alfalfa was not

generally recognized, however, until the attention of the Minnesota Agricultural Experiment Station was called to it, and efforts were made by that station to extend its culture. In 1905 the United States Department of Agriculture began to experiment with this variety, and since that time it has been grown in comparison with a large number of other varieties and strains, and in practically every case has proved itself equal, if not superior, to any of these in hardiness.

To the casual observer the Grimm alfalfa does not differ materially from the common strains, but a closer examination will reveal a greater diversity of forms, upright and decumbent individuals often occurring side by side. A large percentage of the flowers are of the same color as those of common alfalfa, but there are a few that are greenish, smoky, or blackish, and occasionally a plant is found with yellow flowers, indicating definitely that the strain is the result of a cross between the common and yellow-flowered species. Variegated flowers are usually more in evidence in semiarid than in humid districts.

The taproots show a tendency to branch and the crowns to be low set and spreading, characters which are undoubtedly of great importance in rendering a variety resistant to cold. In ability to produce seed Grimm alfalfa is about equal to most of the common strains.

The hardiness of Grimm alfalfa is probably due in part to the presence of the yellow-flowered alfalfa in its ancestry and in part to the process of natural selection which took place under the severe climatic conditions to which it was subjected for a long period of years in Minnesota. On account of its superior hardiness, the variety is particularly recommended for the northern part of the Great Plains region and all parts of the Northwest where little protection is afforded by the snow. It has also proved better able to survive the winters in the colder portions of the humid section of the country, where winterkilling is a serious factor. The greater cost of the Grimm seed and the inability of the variety to produce as large yields of hay in a mild climate as the common alfalfa will have a tendency to confine its culture to the more northern States, where hardiness is essential to the success of the crop.

When Grimm alfalfa first began to demand attention, all of the seed was produced in Minnesota; but, as conditions there are not especially favorable for seed production, stock was sent to Montana and other Western States in order that the available supply might be more rapidly increased. Carefully conducted tests of Grimm seed produced in Montana, Idaho, and the Dakotas indicate definitely that it has not decreased any in hardiness as a result of having been grown for one seed generation under these changed conditions. Seed is now readily available, but at a price somewhat above that asked for common alfalfa. As a result, unscrupulous dealers have offered for sale large quantities of common alfalfa under the name of Grimm. Because of this practice, prospective purchasers should take every means possible to learn whether seed is true to name.

BALTIC

There is no authentic record of the introduction of Baltic alfalfa into this country, although there is no doubt that the original stock

came from Europe. The name Baltic was first applied to it in 1906, for the reason that it had been grown near Baltic, S. Dak., for about 10 years and not, as has been supposed, in the Baltic Sea region of Europe. The original seed sown at Baltic was purchased from a dealer at Hartford, S. Dak., but further than this no information regarding the history of the seed is available.

The Baltic differs slightly from the Grimm alfalfa in some minor details, but the two are so similar that it is seldom possible to distinguish one from the other, and the description as given for the Grimm variety applies equally well to the Baltic. In general, the two varieties may be considered equally valuable.

The Baltic alfalfa has unquestionably been developed in much the same way as the Grimm and therefore owes its hardiness to the same causes: The presence of the yellow-flowered alfalfa in its ancestry and the natural elimination of the less hardy plants which has taken place since its introduction into this country.

This variety is best suited for sections where the ordinary strains suffer considerable loss through winterkilling. This includes practically the same territory to which the Grimm is best adapted, and since comparative tests have shown very little difference in the hay yields of these two varieties, Baltic alfalfa has been almost entirely replaced by the Grimm variety, over which it has no special advantages. From the evidence that is now available, it is safe to conclude that seed of these alfalfas should be approximately the same price, and the farmer would not be justified in purchasing seed of one at any considerable advance over the other.

COSSACK

Cossack alfalfa was introduced into this country from Russia through the efforts of the United States Department of Agriculture in 1907. It is not as yet an important variety commercially, though receiving an increasing share of attention.

It is a comparatively early generation hybrid, and for this reason the flowers show a higher percentage of variegation than those of the older and better known strains of this group, such as the Grimm and Canadian variegated.

In the tests that have been conducted, Cossack alfalfa has compared favorably with Grimm and other variegated alfalfas but has shown no evidence of being superior for most conditions. Because of the rather limited supply, its seed ordinarily sells for appreciably more than that of the Grimm variety, but the evidence at hand indicates that the farmer is not justified in paying more for it.

CANADIAN VARIEGATED

Because of the excellent showing made in the United States by certain lots of alfalfa seed procured from Canadian sources, the United States Department of Agriculture was led to make an investigation of the fields where the seed was produced, most of which are located in lower Ontario. Upon inquiry it was learned that at least part of the original stock came from France, and it is very probable that some of it was from the sand lucern which is grown in that country as well as in other parts of Europe, since the strain as now produced has its characteristics, including variegated flowers.

The fact that it is of hybrid origin, together with the natural selection that has taken place since its introduction into Canada, is responsible for its superior hardiness.

Canadian variegated alfalfa is very similar to the Grimm variety as regards the color of its flowers and its general habit of growth. In fact, these strains are so much alike that it is seldom possible to distinguish one from the other. It also compares very favorably with the Grimm variety in yield of seed and hay, but, like it, does not yield so much as common alfalfa where the latter can be successfully grown. The Canadian variegated has proved more resistant to cold than the common variety and is therefore adapted to the same general region as the Grimm alfalfa. In the New England States and in other States having approximately the same latitude, its superior hardiness as compared with the ordinary alfalfa has been pretty well demonstrated. In tests conducted in the Northwestern States, however, it has not proved quite so hardy as the Grimm variety.

Practically all the Canadian variegated alfalfa seed imported into the United States is grown in the vicinity of Silverdale, Ontario. As the supply is rather limited, it commands a slightly higher market price than ordinary alfalfa, although generally selling for somewhat less than seed of the Grimm variety.

SAND LUCERN

It is only during the last 30 years that any attention has been given to sand lucern in the United States, even in an experimental way, although there is little doubt that small quantities of such seed had reached this country many years previously. In 1889 it was grown in experimental plats at the Delaware Agricultural Experiment Station; in 1891 at the North Carolina Agricultural Experiment Station; and near Baton Rouge, La., in 1892. The first noteworthy trial with it was made in Michigan in 1897.

Sand lucern is a hybrid alfalfa and is undoubtedly the parent of our selected strains of variegated alfalfas, such as the Grimm, Baltic, and Canadian variegated. The sand lucern described by the early botanists is quite distinct from the commercial sand lucern. The former probably represents early-generation hybrids, whereas the latter has been modified by repeated crossings with the common alfalfa.

In general appearance the commercial sand lucern is very similar to the common alfalfa. The presence of the yellow-flowered strain in its ancestry is indicated by the weaker and therefore more decumbent stems, by a certain amount of variegation in the flower colors, and by the presence of some pods with fewer and looser coils. In these respects, as well as in many others, it is similar to the Grimm variety.

The commercial sand lucern includes variegated alfalfas that have been grown under all sorts of conditions, and as a result the various lots show no consistent resistance to cold and drought. Some that have been grown for several seed generations under rather severe conditions have become, through natural selection, almost as resistant to cold or to cold and drought as the Grimm variety; others grown under more favorable conditions are no harder than the common strains.

The hardier strains of the commercial sand lucern are to be recommended for conditions similar to those under which the Grimm variety has given satisfactory results. The less hardy strains really have no place in this country, because where they succeed the common alfalfa will grow and give larger yields. Owing to the inconsistency in the behavior of the plants grown from various lots of seed, it is doubtful whether sand lucern should be recommended for general use, particularly since we already have other well-known varieties in the Grimm and Canadian variegated which are equal, if not superior, in hardiness, yield, and seed production to the very best strains of the commercial sand lucern.

NONHARDY GROUP

There are certain alfalfas distinct from the regional strains of common alfalfa which have been developed in the southern part of this country that are especially characterized by long periods of growth, ability to make better growth under short days than the hardier northern strains, and quick recovery after cutting. These alfalfas are so much more seriously affected by low temperatures than the other commercial varieties or strains that for lack of a better group designation they have been classed as nonhardy alfalfas. Commercially only two strains, the Peruvian and the Arabian, have ever attained any degree of importance in this country. Small quantities of seed of other varieties or strains, including the Guaranda and strains from Mexico (which resemble the Peruvian), and the Elche, Algerian, and Oasis (which resemble the Arabian variety), and the India alfalfa from India, have been imported at various times but have never been grown extensively in the United States.

PERUVIAN

Of the alfalfas introduced from Peru, two distinct strains are now very generally recognized in the United States. These strains differ in several respects, but most noticeably in the abundance of hairs on the stems and leaves. It is because of this difference that such names as "smooth-leaved Peruvian" and "hairy Peruvian" as applied to these alfalfas have come into such general use.

These alfalfas were first introduced into the United States from Peru through the efforts of the Department of Agriculture in 1899, but apparently the importations that were made during that year were not perpetuated. The first introduction whose progeny is being grown commercially in this country was made in 1903. The early introductions were very hairy and proved so promising that in an effort to increase the available seed supply a larger quantity was purchased from Peru in 1908. Plants from this lot of seed proved to be less hairy, shorter, and slower in growth than those from the seed of the earlier importation. To distinguish these two strains from Peru, the local growers applied the name "hairy-leaved Peruvian" to the progeny of the introduction made in 1903 and "smooth-leaved Peruvian" to the progeny of the 1908 introduction.

In the early years of the Peruvian alfalfa industry in the Yuma Valley, Ariz., there was on the market a considerable preponderance of the so-called smooth-leaved Peruvian seed, but later investigations indicated definitely that for most parts of the Southwest the

true Peruvian is superior to the smoother type. The former not only grows more rapidly, thus giving a somewhat greater tonnage of hay, but also makes more growth during the winter months, thereby furnishing a larger quantity of pasturage. As a result, there has been a gradual decrease in the acreage of the "smooth-leaved Peruvian" and a proportionate increase in the acreage of true Peruvian alfalfa. Were the true Peruvian no more than equal to the "smooth-leaved Peruvian" in point of yield, the fact that the former has characteristics by which it may be distinguished from common alfalfa, whereas the "smooth Peruvian" can be distinguished only with more or less difficulty, is sufficient ground for discouraging the use of the latter. Unscrupulous seed dealers, however, are continually emphasizing the advantages of the "smooth Peruvian" alfalfa, as this gives them an opportunity to buy mixed lots of seed at the price of common alfalfa and dispose of it as "smooth Peruvian" at a considerably advanced price without being so readily detected.

As compared with common alfalfa, both the Peruvian and the "smooth Peruvian" are more upright, less branched, and have fewer and somewhat coarser stems. (Fig. 3.) In thick stands, however, this difference is not marked. The leaves of the Peruvian are somewhat larger than those of common alfalfa, being longer and as wide or wider. The most striking characteristic of the true Peruvian alfalfa is the pubescence or hairs on the whole plant, giving the foliage a grayish appearance.

Both the Peruvian and "smooth Peruvian" alfalfas are characterized by their rapid growth, quick recovery after cutting, and in sections having mild climates their ability to grow in cool weather and short days after the growth of ordinary alfalfa has practically ceased. Under such conditions they begin growth earlier in the spring and continue later in the fall than most other commercial varieties, thus lengthening their growing season and thereby giving more cuttings during the season. In these respects, however, the



FIG. 3.—A typical plant of Peruvian alfalfa

Peruvian somewhat excels the "smooth Peruvian." In parts of the South both of these alfalfas seem to be somewhat more resistant than other varieties to certain diseases. A tendency for them to become coarse and woody when allowed to stand beyond the flowering stage may be considered a disadvantage.

Lack of hardiness will always confine the Peruvian variety to the southern and southwestern portions of the United States, where the winter temperatures are comparatively mild. It can not be grown to advantage in regions where the temperature falls below 10° F., and efforts to extend its culture into the Central and Northern States are unwarranted and sure to result disadvantageously. The

variety is not drought resistant and therefore is not to be recommended for dry-farming sections.

At the present time Peruvian alfalfa in the United States is mostly grown in Arizona, California, New Mexico, and Texas. The results obtained seem to indicate that its culture can profitably be extended, not only to other portions of these States, but also to sections of other Southern States.

ARABIAN

The earliest recorded importation of Arabian alfalfa was made through the Office of Foreign



FIG. 4.—A typical plant of Arabian alfalfa

Seed and Plant Introduction of the Bureau of Plant Industry in 1902, when two lots were received, one from Basra (Bassorah) and the other from Bagdad, Arabia. From time to time small lots of Arabian alfalfa seed have been received in this country, but in recent years the quantity of such seed imported has been almost negligible.

In general appearance the Arabian alfalfa is not markedly different from some of our common strains, but is readily distinguishable. (Fig. 4.) The plants are typically more hairy, a little shorter in growth, and somewhat more bushy than the ordinary alfalfa. However, the hairiness is not quite so pronounced as in the Peruvian alfalfa. The stems and roots are soft, the former being hollow and quite erect. The crowns spread little and set well above the ground. The leaves are generally larger, lighter colored, and broader in pro-

portion to length than almost any other variety. The imported seed is unusually large, thus necessitating the use of a larger quantity per acre for sowing.

The Arabian variety is characterized by its quick recovery after cutting and by its ability to commence growth earlier in the spring and continue later in the fall than any other alfalfa. This makes it possible under favorable conditions to obtain one or two additional cuttings in a year, but does not result in a corresponding increase in yield.

The greatest objection to Arabian alfalfa is its tendency to be short lived. Under ordinary field conditions a good stand may be maintained for two years. The third year the plants are less vigorous and the stand decidedly thinned out. The fourth year very few plants are left. Another objection is its poor seeding habits in this country, which render the variety rather difficult to perpetuate.

Arabian alfalfa is not cold resistant and can be grown successfully only in sections having comparatively mild winters, such as occur in our Southern and Southwestern States. It is not injured by high temperatures when there is an abundance of moisture in the soil. Because of its inability to resist drought, this variety is not suitable for dry-farming sections.

At the present time there is very little Arabian alfalfa in the United States, and results obtained in most cases indicate pretty clearly that this variety, all things considered, is not equal to either the Peruvian or ordinary alfalfa for general use, even in those parts of this country to which it is best adapted.

YELLOW-FLOWERED GROUP

In a fifth group are included the various forms of the yellow-flowered species,⁴ sometimes referred to as "Siberian alfalfas." This term, however, is misleading, since not all of the yellow-flowered alfalfas come from Siberia. These alfalfas are of comparatively little agronomic importance at the present time, but they have been so extensively exploited that it is deemed advisable to discuss them along with the important commercial varieties of alfalfa.

The first importation of any of the forms of yellow-flowered alfalfa of which there is a record was made by the Department of Agriculture in 1898. Accidental introductions, however, occurred before that date. Since 1898 numerous lots of seed have been procured from various parts of Europe and Asia. The plants from these importations vary greatly in their characteristics, including habit of growth. Most of them are procumbent (fig. 5); a few are nearly as erect (fig. 6) as the ordinary purple-flowered alfalfas. Few of the forms possess true taproots, but have a much-branched root system. In general, the crowns are produced somewhat below the surface of the ground, a protective adaptation which enables the plant to endure cold and drought. The flowers are yellow, and the seed pods are crescent or sickle shaped.

The Department of Agriculture has thoroughly tested many forms of the yellow-flowered alfalfa in various parts of the country. The results of these tests lead to the conclusion that their chief value is for hybridizing with the purple-flowered alfalfas in order to

⁴ *Medicago falcata*.

produce hardy and drought-resistant strains. It is believed that of themselves they are not sufficiently productive to be profitable under cultivation, since they rarely give more than one cutting in a season. Furthermore, most of the forms are not sufficiently erect to be harvested for hay by field machinery, and almost without exception they produce seed very scantily. A few of the best forms of the yellow-flowered alfalfa give one cutting of hay that frequently outyields the first crop of the ordinary commercial varieties. However, the higher yield in this one crop seldom offsets the inability to produce more than one cutting in a year.

For use on uncultivated pasture and range lands, the tests so far indicate that these alfalfas are not sufficiently aggressive to be of much value. In fact, it is very doubtful whether even a scattering

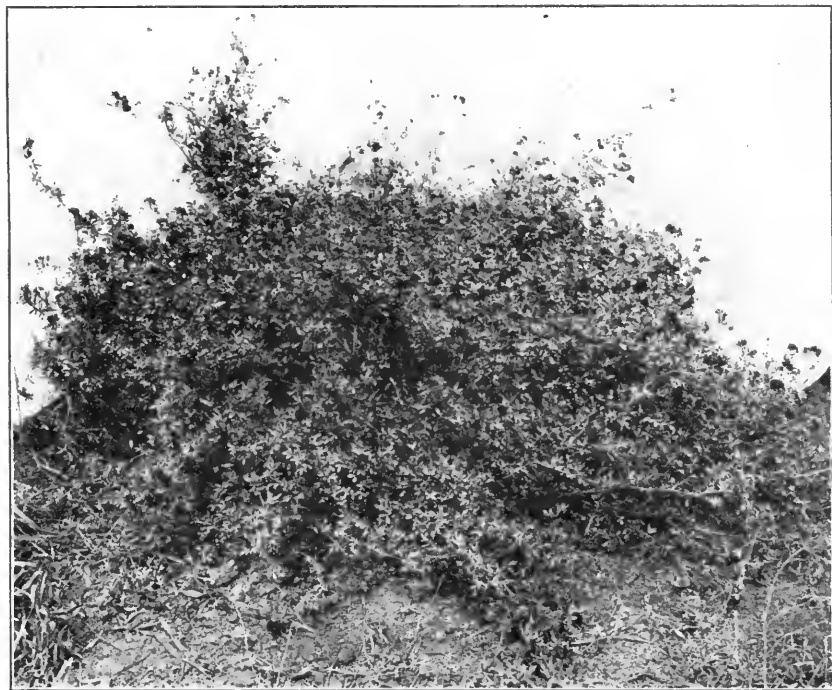


FIG. 5.—Yellow-flowered alfalfa (*Medicago falcata*), decumbent type

stand of plants would survive on the average dry range, even if careful attention were given to seeding.

The Department of Agriculture advises farmers to go to no great trouble or expense in testing these yellow-flowered alfalfas at the present time, as there is still much work for plant breeders to do.

There are two forms or, rather, two importations that have received considerable attention by reason of being extensively advertised in agricultural journals. They are known as the Semipalatinsk and Orenberg, receiving their names from the Provinces in Siberia and Russia from which they were imported. These lots are superior in some respects to many other forms of the yellow-flowered alfalfas, but they are composed of mixed strains and are subject to the same objections that apply to the group as a whole.

VARIETIES FOR VARIOUS SECTIONS

In recent years numerous tests have been conducted in all parts of the United States with alfalfas from various sources. These tests have had as their main object the determination of the variety or strain that can be most profitably grown in a specific locality or under certain conditions. As a result of extensive tests it is now possible to designate with considerable definiteness the part of the country where each of the various commercial strains or varieties may be expected to give the most satisfactory results. (Fig. 7.) There are, however, more or less extensive areas in all parts of the United States where the conditions are so unfavorable to alfalfa that an attempt to produce any of the known varieties or strains is



FIG. 6.—Yellow-flowered alfalfa (*Medicago falcata*), one of the more erect forms

almost certain to result in their failure to grow or in their inability to give profitable yields.

In choosing a variety or strain it is well to bear in mind that the quick-growing alfalfas, because of their tendency to produce heavier yields, should be used as far north as they will survive the winters. The variegated alfalfas, including the Grimm, Baltic, Cossack, and Canadian variegated, have usually proved more resistant to severe winter conditions than the ordinary strains and therefore give the most satisfactory results where winterkilling is a serious factor. They are not to be recommended generally, however, for conditions where ordinary alfalfas will succeed, owing to the higher cost of the seed and to the fact that they have a tendency to yield less than

England States, New York, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, South Dakota, Montana; northern Nebraska, Illinois, Indiana, Ohio, and New Jersey; the greater part of Pennsylvania and Wyoming; and the western half of Colorado. There are, however, areas in several or all the States mentioned where the soil or climatic conditions are exceptionally favorable to the growth of alfalfa and where the common alfalfa will give more profitable returns. Such areas occur on the limestone soils of New York, Michigan, Wisconsin, and Ohio, as well as parts of Massachusetts, Rhode Island, Connecticut, and Long Island where the climate is modified by proximity to the ocean, thus reducing the losses from winter-killing. If difficulty is experienced in obtaining seed of the Grimm or other hardy variegated varieties for the northern part of the United States, it is recommended that seed of some good northern

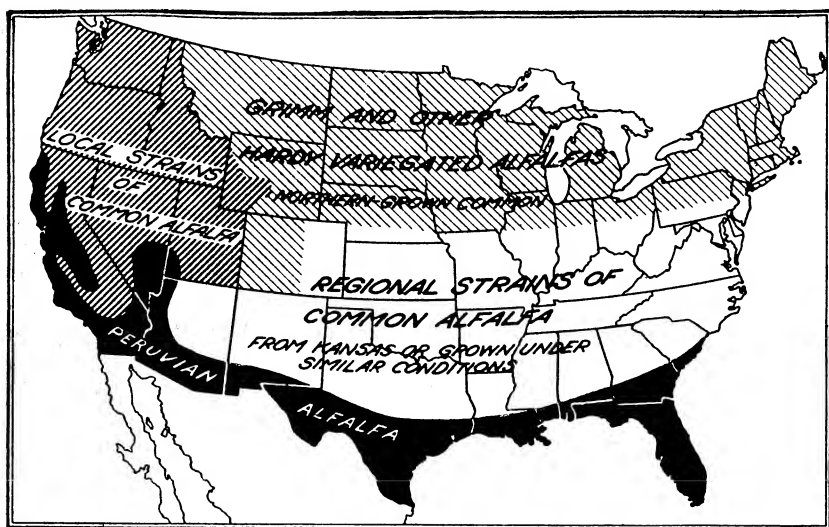


FIG. 7.—Outline map of the United States, showing the varieties or strains of alfalfa that are recommended for various sections, based upon climatic conditions

regional strain be procured. For such conditions these strains generally have proved to be superior to those from farther south.

In sections having very mild winters, Peruvian alfalfa has proved more profitable than any other commercial variety or strain, owing to its ability to produce considerably heavier yields. Usually it can be grown to advantage only in sections where the minimum temperature is not lower than 10° F. and where ordinary alfalfa will succeed. The section to which this alfalfa is adapted includes the greater part of California, except the mountainous portions; southern Arizona; southern New Mexico; southern Texas; and a strip of country bordering on the Gulf of Mexico and extending northward along the Atlantic Ocean, finally ending in the vicinity of Charleston, S. C. In all the great belt of country lying between the area on the south where Peruvian alfalfa has proved most profitable and the line on the north marking the southern limit of serious winterkilling and extending westward from the Atlantic Ocean to the Rocky Moun-

tains, the common strains that have been developed in Kansas, Oklahoma, Texas, and under similar conditions have given the most satisfactory results. They are somewhat more satisfactory for this area than the common strains from the intermountain region.

In the intermountain region, which embraces practically all the United States not included in the three preceding regions, seed from locally developed strains generally gives as satisfactory results as that from other sections of the country, although here, too, in some of the valleys having high altitudes Grimm alfalfa is preferred. The States or parts of States falling in this group are Idaho, Nevada, Utah, southwestern Wyoming, the mountainous portions of California, and the greater part of Oregon and Washington.

PURCHASING SEED

Before buying alfalfa seed there are three points upon which the purchaser should have information: The name of the variety, the section of the country in which it was produced, and the quality of the seed with regard to both germination and purity. Unfortunately, it is not possible to distinguish between varieties or strains of alfalfa by the appearance of the seed, and the tests that so far have been developed to assist in this connection are not of much practical value to the farmer. Except in the case of imported Russian Turkestan seed, there is no easy means of telling from the appearance of a sample of seed where it was grown. It is important, therefore, that dealings be had only with thoroughly reliable and intelligent seedsmen and growers.

The viability of the seed, or its ability to germinate, is clearly indicated in its appearance. Plump seed of a bright olive-green color almost invariably germinates well, while shriveled seed or seed that is of a brownish color usually germinates poorly. With age alfalfa seed turns a reddish brown color. Some viable seed may possess this color, but such seed should not be purchased without a germination test, even if it is offered at a price materially less than that asked for seed of a fresh olive-green color. When a germination test is desired it can be made by placing 100 seeds between cloths or blotting paper and keeping them moist and at a temperature of about 70° F. After five or six days most of the readily viable seeds will have sprouted. There will be some, however, that will remain hard, especially if they are of the variegated varieties. Many of these hard seeds will grow when put in the ground, and therefore they should be considered in estimating the percentage of germination. The Department of Agriculture, through its main seed laboratory and branch laboratories, is prepared to make a limited number of germination tests free of charge; but, in order to prevent delay beyond the seeding time, samples should be mailed to the department at least two months in advance.

With regard to the purity of alfalfa seed, every farmer should be able to recognize readily the most important weed seeds and other impurities that are commonly found in it. Seed to be acceptable should contain not more than 2 per cent of impurities. At the present time there is almost no attempt to adulterate alfalfa seed in this country, but every lot should be very carefully examined for seed of noxious weeds, especially dodder, before it is purchased. The seeds

of dodder are smaller than those of alfalfa, more nearly round, and have a pitted surface which can be detected only by the aid of a lens. As dodder is a troublesome weed and its seed can not readily be separated from that of alfalfa, dodder-free seed should be demanded by the purchaser. Seeds of buckhorn should always be looked for when samples of alfalfa seed are examined before purchasing. These seeds are shiny brown in appearance, boat shaped, and about twice the length of the alfalfa seed. Seed of Russian knapweed, which has previously been described, should also be searched for carefully, as its presence indicates the imported Turkestan variety. (See fig. 2.) Although the Seed Laboratory of the Department of Agriculture is prepared to make a purity analysis of

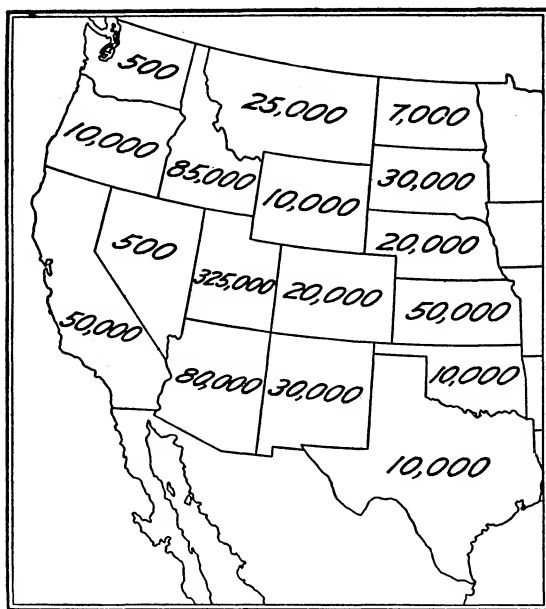


FIG. 8.—Map showing the estimated production (in bushels) of alfalfa seed in 1924 in the States lying west of the ninety-fifth meridian, based on information obtained by the seed-reporting service of the Bureau of Agricultural Economics, United States Department of Agriculture

a limited number of samples free of charge for private individuals, it is very desirable that every farmer acquaint himself with the impurities and noxious weed seeds that alfalfa seed commonly contains, in order that there may be no serious delay in purchasing seed for sowing.

SEED PRODUCTION

In keeping with the demand resulting from the gradual increase in alfalfa acreage, there has been a yearly increase in the production of alfalfa seed. The census of 1909 places the seed production at approximately 16,000,000 pounds.

According to the best estimates of the seed-reporting service of the United States Department of Agriculture this had increased to 25,000,000 pounds in 1921, 30,000,000 in 1922, 33,000,000 in 1923, and 45,000,000 in 1924. The commercial production of alfalfa seed in this country is confined largely to that region lying west of the ninety-fifth meridian where irrigation and dry-land farming are practiced. The estimated number of bushels of seed produced in 1924 by each State lying west of this line is shown on the accompanying map (fig. 8). Most of the seed of the Grimm variety is produced in Idaho, Montana, North Dakota, South Dakota, and Nebraska. The Peruvian seed industry is confined almost entirely to those portions of California and Arizona known as the Yuma Valley. Only a small quantity of seed is grown east of the ninety-fifth meridian, as

alfalfas do not produce seed satisfactorily under humid conditions. For this reason it is seldom profitable to attempt to grow seed in the Eastern States. It is true that there are limited areas in these States where comparatively small quantities of alfalfa seed are produced, but they are exceptions. Ordinarily it is very much more profitable for the eastern farmer to purchase seed that is produced in the West than to attempt to grow it.

POSSIBILITIES IN BREEDING

There are possibilities in the breeding of alfalfa for the production of strains that will be more resistant to cold and drought or better adapted to special conditions than those that are at present in general use. However, to establish a new strain of alfalfa involves such a long period of time and so much labor and expense that farmers can hardly afford to undertake work of this kind. The breeding of alfalfa, which includes both selection and hybridization, is properly the work of the United States Department of Agriculture and the various State agricultural experiment stations, since these institutions are much better equipped for such work than private individuals. In this country most of the alfalfa breeding is, and doubtless always will be, confined largely to sections west of the Mississippi River, where the conditions are more favorable for the production of alfalfa seed.

PUBLICATIONS RELATING TO ALFALFA

[These may be ordered by their numbers]

The following Farmers' Bulletins relating to alfalfa will be sent free of charge upon application to the Department of Agriculture, Washington, D. C.:

- 636. The Chalcis-Fly in Alfalfa Seed.
- 677. Growing Hay in the South for Market.
- 865. Irrigation of Alfalfa.
- 943. Haymaking.
- 944. Controlling the Garden Webworm in Alfalfa Fields.
- 977. Hay Caps.
- 982. Control of the Green Clover Worm in Alfalfa Fields.
- 987. Labor-Saving Practices in Haymaking.
- 1094. The Alfalfa Caterpillar.
- 1185. Spraying for the Alfalfa Weevil.
- 1229. Utilization of Alfalfa.
- 1232. Seed-Marketing Hints for the Farmer.
- 1250. Green Manuring.
- 1265. Business Methods of Marketing Hay.
- 1283. How to Grow Alfalfa.

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February 5, 1926

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22

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